

“In the name of GOD”

“Introduction to Chemical Engineering”

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(Tehran PolyTechnic)

Chemical Engineering Faculty

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“Truth”; Dedicated to:

... My Mom and Dad from whom I learned love and truth . . .

... My son Sohrab, who strongly, like Sohrab the hero, supported me every single moment, to write this book . . .

... My son Sahand, for his stability, like his namesake Sahand Mountain . . .

Professor Tahereh Kaghazchi's foreword

The book "Introduction to Chemical Engineering" written by Ms. Parivash Hosseinpour is the result of years of experience in education and research in different areas of Chemical Engineering. The author with patience and passion has collected materials needed for students in elementary and advanced Chemical Engineering. The author, in different chapters of the book, has included main subjects in detail; in addition to the main subjects which include Separation Processes, Chemical Reactor Design, Equipment, Machines, Utilities and other services, has considered and analyzed graphical symbols, use of computers in chemical engineering and introducing applicable software in chemical engineering with high precision.

In addition to introducing main text books, references and handbooks, the author is also familiarizing the engineering students with scientific literature and communication skills.

This book without a doubt is unique and useful. I hope Chemical Engineering students studying this book will better realize the importance of chemical engineering and be more successful in their future careers.

With the best wishes for the author and all chemical engineers in Iran.

Professor Tahereh Kaghazchi

Amirkabir University of Technology – AUT

(Tehran Polytechnic)

Chemical Engineering faculty

Professor G. A. Manssoori's foreword

This book, which has been written with exceptional precision, includes very useful information to familiarize students with overall principles of chemical engineering. Basic definitions, process equipment, machines, utilities, plants and overview of unit operations are well defined.

Therefore in addition to recognition of Ms. Parivash Hosseinpour's efforts, I wish her success for this book and future books.

Professor G. A. Manssoori

University of Illinois at Chicago

Chemical Engineering, Biomedical Engineering and Physics Faculties

Professor Manochehr Nikazar's foreword

From what I know about the author's industrial, educational and research activities since she was a student, writing such a complete book to familiarize the students with basic, advanced and comprehensive knowledge of different fields in Chemical Engineering is not unexpected.

The book has been written very well, and includes useful information regarding basic understanding of Chemical Engineering, principles, tasks and duties of Chemical Engineers in industry, unit operations and equipment. In addition specific and special related software is introduced with excellent writing and description. Therefore studying this book for the first two years of Chemical Engineering students is a must.

In addition to my thanks for Ms. Parivash Hosseinpour's efforts in writing this book, I hope this book will be well received and successful to increase her enthusiasm for future books.

Professor Manochehr Nikazar's foreword

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Acknowledgements:

I would like to thank Dr. Tahereh Kaghazchi Professor of Amirkabir University of Technology – AUT (Tehran Polytechnic) Chemical Engineering faculty; Dr. G. A. Mansoori Professor of University of Illinois at Chicago – UIC Chemical Engineering, Biomedical Engineering and Physics Faculties; Dr. Manochehr Nikazar Professor of Amirkabir University of Technology – AUT (Tehran Polytechnic) Chemical Engineering faculty; for writing encouraging forewords for this book.

I also thank Dr. Mansooreh Soleymani for all her help; Dr. M. H. Namazi for nominating me to teach this course, and also Engineer Kamran Keynezhad and Mr. Fazel shokohi.

My endless thanks are presented to my sons, Sahand and Sohrab, great persons for all their supports.

Parivash Hosseinpour

Preface

“Introduction to Chemical Engineering” has been written for Chemical Engineering students as well as for those who are working in industrial plants and interested in Process Engineering. This book has been written based on the curriculum approved by the Ministry of Higher Education. Extensive applications of Chemical Engineering are described in this book and also familiarize students with their future studies to be an engineer. Subjects of this book can be used as a reference for all their future studies and jobs in industry.

Six chapters describe the main subjects which a Chemical Engineer needs to know, including:

- 1. “**Introduction to Chemical Engineering**”; this chapter explains overall subjects and the reason why the Chemical Engineering branch establishment was necessary.*
- 2. “**Main processes and equipments**”; students study main processes, related machines and equipments in chapter two.*
- 3. “**Chemical reactors design**”; this chapter introduces the basics of chemical reactors, which are specific to the Chemical Engineering branch and do not overlap with any other engineering branch.*
- 4. “**Machines, equipments, Utilities and other services**”; Main processes (separation and chemical reactors) need many services; these services are completely described in chapter four.*
- 5. “**Symbols, Process Planning, Scheduling and Flowsheet Design**”; chapter five describes how a Chemical Engineer should start to design an industrial plant, defining the process engineer’s duties, what they need to start a feasibility study. All symbols, codes, different flowsheets, flow diagrams, flowcharts, how to read and use them, etc. are well explained in this chapter.*
- 6. “**Software and Scientific References in Chemical Engineering**”; application of computers, software, handbooks, text books and other*

Scientific References in Chemical Engineering are introduced in this chapter.

Considering this is a textbook, it is necessary to mention some points. Chemical Engineering is a comprehensive engineering branch and is one of the three mothers engineering branches like Mechanical Engineering, Electrical Engineering and Civil Engineering, (because separation and engineering of chemical reactions do not overlap with other engineering branches). This book is very useful for all different subdivisions of Chemical Engineering such as: the Petrochemical, Refining, Gas, underground Reservoirs and Oil, Polymer, Food, Environmental, and other related chemical industries.

Since this is the first edition of this book to be published, I am sure it may not be error free and I will appreciate any suggestions and/or corrections.

Parivash Hosseinpour

Summer 2011

Course plan

Course name: *Introuduction to Chemical Engineering*

Course Aim:

The objective of this course is to familiarize the student with Chemical Engineering and show a principled, simple and fun way for their undergraduate learning duration; in addition how to use their knowledge to solve industries' problems.

Since the student should be familiar with principals of scientific and technological literature, to be able to present obtained data, findings and researches as a written report and/or oral report; therefore it is necessary to practice "Scientific Literature and Communcation Skills" in this course. In this section, methods of research, writing articles, projects, written and oral reports, how to prepare and present their presentation will be discussed.

In addition students should become familiar with the issue of Intellectual Property Rights – IPR issues and respect for them.

Ministry of Higher Education Syllabus:

Introduction to Chemical Engineering

Amirkabir University of Technology – AUT, (Tehran Polytechnic) Feb. 2001.

Curriculum

In this course Processes of Chemical Industries and server equipments introduced to students, as follows:

- ✓ *Definition of Chemical Engineering*
- ✓ *Separation process equipment:*
 - *Distillation*
 - *Evaporation*
 - *Crystallization*
 - *Drying*
 - *Filtration*
 - *Leaching*
 - *Extraction*
 - *Absorption*
 - *Adsorption*
- ✓ *Exchange process equipment:*
 - *Heat exchangers*
 - *Furnaces*
 - *Boilers*
- ✓ *Equipment for Transportation and Storage of chemicals:*
 - *Pumps*
 - *Fans, Blowers and Compressors*
 - *Tanks*
- ✓ *Chemical Reactors*
- ✓ *Applications of computers in Chemical Engineering*
- ✓ *Graphical symbols in industries related to Chemical Engineering*
- ✓ *Report writing techniques*

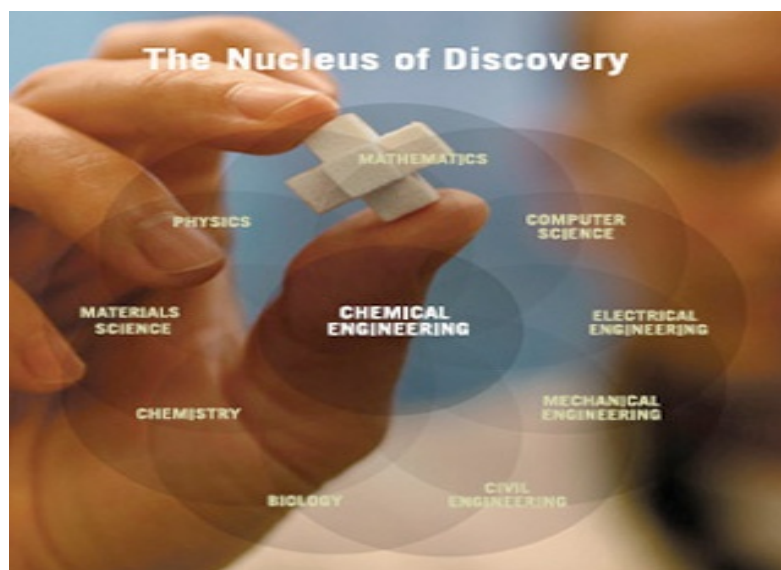
Biography

Ms. Parivash Hosseinpour studied her B.Sc. and M.Sc. in Amirkabir University of Technology – AUT, (Tehran PolyTechnic), Chemical Engineering Faculty, Petrochemical branch. Following her academic research she started to collaborate with the University of Texas at Dallas, UTD – NanoTech Institute in the Nanotechnology field. The outcome of Nanotechnology research is presented in many conferences. Regarding to her Nanotechnology investigations she patented her idea, CNTs – Cement composites, in Iran. Considering her educational, scientific and technological activities, she has been awarded many prizes and other recognitions.

During her employment in AUT, Ms. Parivash Hosseinpour was lecturer for “Nanotechnology and Applications” and “Introduction to Chemical Engineering” courses. The “Nanotechnology and Applications” course was approved following her suggestion, and she also defined the syllabus, then started to write this course’s text book, “Nanotechnology: Principles & Applications”. Presenting this course was well-received by students of all different engineering branches at AUT. In Feb. 2001, Ministry of Higher Education defined “Introduction to Chemical Engineering” as a course. From the beginning Ms. Parivash Hosseinpour started to teach this course and also write the book according to the defined syllabus and more explanations for students’ future studies as a reference.

Engineer Hosseinpour during her service at the AUT, besides teaching the above two courses she has also taught Unit Operation, Heat Transfer, Physical Chemistry and Organic Chemistry Labs. She has successfully held various positions during her employment in AUT, including: director of “Nano-Research Center” in the Chemical Engineering Faculty, Director and Designer of Faculty’s website, and many other educational and research activities.

www.Parivash-Hosseinpour.com



Chemical Engineering the Nucleus of Discovery [7].

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1

“Introduction to Chemical Engineering”



A view of a refinery plant [6].

Chapter one references

2

“Main Processes and Equipments”

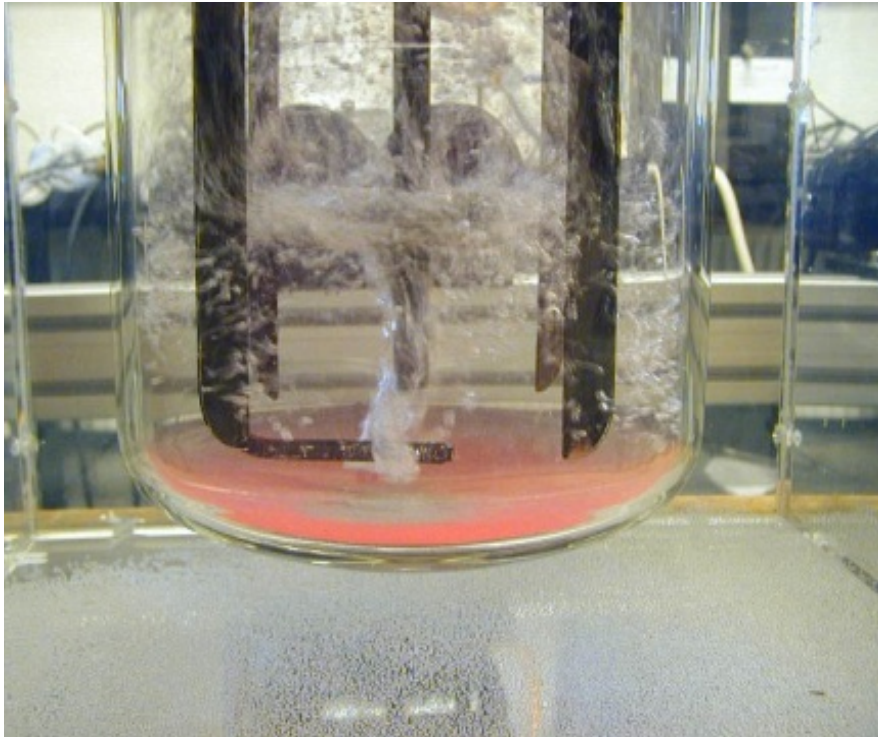


A view of a industrial plant [9].

Chapter two references

3

“Chemical Reactors Design”

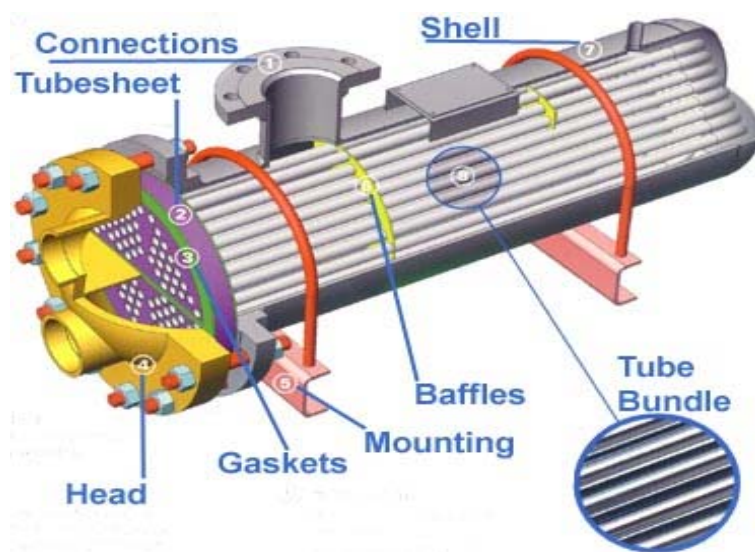


A Chemical Reactor [2].

Chapter three references

4

“Machines, Equipments, Utilities and Other Services”

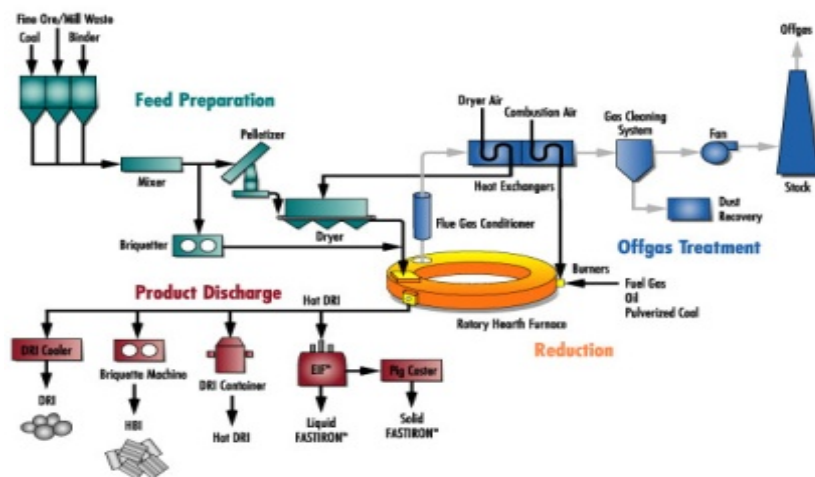


Heat exchanger [14].

Chapter four references

5

“Symbols, Process Planning, Scheduling and Flowsheet Design”

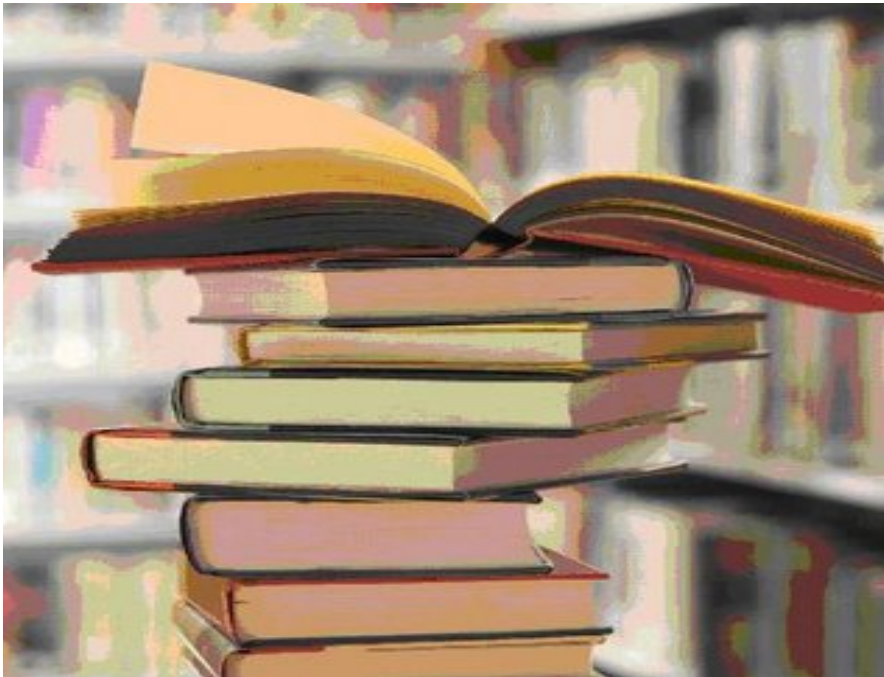


Flowsheet [2, 3].

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6

“Softwares and References in Chemical Engineering”



[2]

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